IASET: Journal of Applied and
Natural Sciences (IASET: JANS)
ISSN(P): Applied; ISSN(E): Applied;
Vol. 2, Issue 1, Jan - Apr 2016; 1-8

International Academy of Science,
Engineering and Technology
Connecting Researchers; Nurturing Innovations

ANALYSIS OF DEFORESTATION DRIVERS IN STUDY AREA TEHSIL BARAWAL DIR UPPER PAKISTAN

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ABSTRACT

Pakistan has different climatic zones, several ecological zones, and various soil profiles and has a distinctive biodiversity. The area of Pakistan forest is 4.8% of the total geographical land and the forest are in facing a titanic problem of deforestation. Field survey and Remote Sensing (RS) and Geographic Information System (GIS) techniques both are the superlative approaches to identify those areas of deforestation and to identify different drivers of deforestation in study area in Tehsil Barawal, District Dir (U). The main objective of the study was to identify different drivers of deforestation in study area. The results of field survey revealed that there are seven drivers of deforestation, source of income from forest, fuel wood collection, illiteracy rate, agriculture expansion, forest fire, illegal cutting/harvesting and encroachment. In the study area 40 % of the respondents approved that agriculture is one of the main drivers of deforestation while 24% of respondents agreed that fuel wood collection and 19% were agreed that the illegal cutting is main driver of deforestation. A positive technique like supervised image classification was used for Land sat 5 satellite image of the year 2000 and 2012. The study area was mainly consisting of five classes such as forest, agriculture, barren land, snow and water. In year 2000 the area of forest, barren land, agriculture, water and snow 49.53%, 43.39%, and 5.19%, 1.30% and 0.59% while in year of 2012 area was 37.16%, 41.37%, and 12.69%, 5.04% and 3.73%. After investigation of RS and GIS data it was cleared that from year 2000 to 2012 the forest land was decrease 12.36%, agriculture was increase 7.5% barren area decrease 2.03%. Therefore from field as well as from GIS and RS results that was cleared that agriculture is the key driver of the deforestation study area.

KEYWORDS: Analysis of Deforestation Drivers in Study

INTRODUCTION

Forest area of Pakistan is 4.8 million hectare (Lubna, 2001; Government of Pakistan, 2005). Pakistan forest assets consist one of the oldest and second largest Juniper forests in the world. In According to (Siddiqui et al., 2006) Pakistan is the second highest deforestation country in world where annual deforestation rate is 4.6 %.Deforestation rate of 1.5% per year has been indicated in Pakistan (FAO, 2005).In a report (Hasan, 2000) explain that per capita forest cover in Pakistan presents a gloomier representation because forest per capita of Pakistan is 0.03 hectares while representing figures for the developed and the developing countries are 0.50 and 1.070 respectively. Pakistan different types of forest are present the conifer forest are situated mainly in Khyber Pukhtunkhwa (KPK) Northern Areas, northern Punjab, Balochistan and

Kashmir (AJK). These forests are found at altitudes 1,000 to 4,000 meters (Qazi, 1994). The northern part of the country is dominated from the evergreen forest (42% in Khyber Pakhtunkhwa and 16.6% in Gilgit Baltistan and 7.7% in Azad Kashmir). These forests largely situated in Khyber Pakhtunkhwa and spread over the mountains of Hindukush, Himalayas and Korakoram (Khan, 2009).The (Khan& Naqvi 2000) reported that in Khyber Pakhtunkhwa trees and forest resources have an essential role in the rural livelihood. Most of peoples depend on forests for timber for houses and fuel wood fodder for livelihoods. In addition, forest people collect diverse non-timber forest products for use at the household level and for cash income. According to the United Nations Framework Convention on Climate Change (UNFCCC)48% agriculture practices was the major cause of deforestation while 32% of deforestation is in charge of commercial agriculture, logging is in charge 14% for deforestation and 5% of fuel wood collection is in charge of deforestation (UNFCCC, 2007).There are two main drivers of deforestation direct and indirect (Helmut et al, 2002). Direct drivers are those causes directly leading to forest decline. For example, forest into agricultural land excessive logging. The (Rademakers et al., 2010) define indirect drivers are a complex interaction of economic, governance, technological, and demographic. According to (Boakyeet al., 2008), due to human activates the vegetation cover happened changes (growth of population) and environmental influences likely changeability in climate. The human activities such as agricultural practices, mining, infrastructural and other anthropogenic activities are the major causes of environmental degradation (Yang, 2001) and according to (FAO, 2006) Forest covers are rapidly degraded due to cultural, economic and multi social factors. Therefore the most important reason of the study was to identify different drivers of deforestation in study area Tehsil Barawal District Dir (Upper).

MATERIALS AND METHOD

Study Area

Tehsil dir upper which is located at North West of Pakistan and dominated from different forest Total house hold of the area are 355 as per district censes report of upper Dir 1998 (Upper Dir, 1998). The people of the study area are hugely defended on forest. Tehsil Barawal have different types of forest i.e deodar (Cedras deodar) and spruce mixed fir (Abies pindrow) and pinus (pinus roxbergai) forests, (Picea smithiana) blue pine (Pinus wallichiana), forests and different fruits trees (Walnut. Chalgoza). Pakistan Metrological Department is divide the area in to different climate zones (i.e sub humid, sub-tropical and sub humid temperate)

Methodology

The ultimate reason of the field survey was conduct to accumulate qualitative and quantitative information to better recognize the drivers of deforestation in the area. The main survey was carried out on August and September 2013 between 08:00 am and 16:00 pm which is the most important time of people activities. The total population of study area is 61674. Study area covers three Union Councils i.e. Barawal Bandi, Darkand, Shahikot, The total houses of the area are approximately 350. The 75 questionnaires were collected from three union councils. Neither the questionnaire was lost nor returned incomplete thus having 100% response rate. To find out drivers of deforestation from remote sensing image it’s involved classification of image. The classification of image procedure

The flowing steps was carry out in procedure of image processing; (1) Data collection, 2) Data preparation, 3) Supervised image classification, 4) Analysis and 5) Preparation of change detection maps. ERDAS imagine 9.2 and Arc GIS 10 software were used for GIS and Remote sensing data.

- **Data Collection**

The200 and 2012 images were downloaded for research data from the landsat 5 satellite Of the United State of Geological Survey website (http://glovis.usgs.gov/).

- **Data Preparation**

The comprehensive analyses for data preparation we were refine satellite imagery.

- **Supervised Image Classification**

The Classification is the process of sorting pixels into a limited number of individual classes, based on their data file values or category of data. The Supervised Image classification has following three sub steps that were help on image classification.

- **Pattern Recognition**

Pattern recognition is the science and art of find the meaningful patterns in data, which can be extract through categorization. By spatially and spectrally enhancing an image, pattern recognition can be performed with the human eye.

- **Training Stage**

Supervised training is strongly controlled by the researcher. In this process, researcher select pixels that characterize patterns or land cover features that he recognizes. Information of the data, and of the classes preferred, was required before classification. By identify patterns one can initiate the computer system to classify pixels with similar characteristics. If the categorization is correct, the resulting classes represent the category within the data that you originally recognized. For our research Forest cover was divided into dissimilar classes or categories such as water, snow, forest, agriculture etc. This stage is additional divided into two parts:

  - Selection of training sites- by using seed pixel method.
  - Selection of Feature Space for classification- that showed least co variance between two bands.

- **Signature Evaluation**

Once signatures are produced, they were evaluating by using Signature Alarm utility. It highlights the pixels in the Viewer that fit in to, or is projected to fit in to a class according to the parallelepiped decision rule.

- **Analysis**

After the field data completion, all the field data were put into Statistical Package for Social Sciences (SPSS) version 19. After arranging the field data, analysis was done through SPSS for all the variables. GIS and remote sensing data are arranged from ARIC GIS 10 and Eradas software.

RESULTS AND DISCUSSIONS

Field Survey Data

A Field survey was conducted in the study area to find out the main cause of deforestation and agriculture development

Respondents Level of Education in the Study Area Barawal Dir Upper

Table 1 depict that majority of respondent were illiterate 60% followed by 24% metric and 12% are undergraduate while very few 4% of them have attained post graduate.

Table 1: Assessment of Education Level in the Study Area of Barawal Dir Upper

S. No	Education	Frequency	%Age
1	Illiterate	45	60
2	Metric	18	24
3	Undergraduate	9	12
4	Postgraduate	3	4
	Total	**75**	**100**

Respondents Source of Income in the Study Area Barawal Dir Upper

The table 2 shows the respondent's source of income. The data indicated that economically 44% respondent are dependent on forest where as 34.67% of respondent depend on agriculture. Similarly 12% are dependent on livestock, 6.66 % Govt. services and 4% have their own businesses.

Table 2: Respondent's Source of Income in Study Area Barawal Dir Upper

S. No	Income Source	Frequency	%Age
1	Forest	33	44
2	Agriculture	25	34.67
3	Livestock	9	12
4	Govt. servant	5	6.66
5	Business	3	4
	Total	**75**	**100**

Respondents Land Use Classes in Study Area Barawal Dir Upper

From the table 3 it was clear that 44% respondents have forest land while 26% of respondents have agriculture land. The reaming 6% respondents have range lands whereas the remaining 10% respondents have barren lands. There are only14% respondents that have mixed land.

Table 3: Respondents Land Use Classes in Study Area

S. No	Land Type	Frequency	%Age
1	Forest	28	44
2	Agriculture	16	26
3	Range land	4	6
4	Barren	6	10
5	Mixed land	9	14
	Total	**63**	**100**

Respondents Fuel wood Collection Per Day Amount in Barawal Dir Upper

Table 4 shows the respondent fuel wood collection from 1 to 30 Kg per day is 86% and 31 to 60 Kg fuel wood collection per day is 6% while 61 to 90 Kg fuel wood collection is 5%. The minimum number of respondent used more than 90 Kg is 3%.

Table Error! No text of specified style in document.**: Respondents Fuel Wood Collection per Day Amount in Study Area Barawal Dir Upper**

S. No		Fuelwood Collection In Kg	Frequency	%Age
1	One Day	1 to 30 Kg	54	86
2		31 to 60 Kg	4	6
3		61 to 90 Kg	3	5
4		More than 90 Kg	2	3
	Total		**63**	**100**

Respondents View about Causes of Deforestation in the Study Area Barawal Dir Upper

Table 5 and show that 40% respondents agreed that agricultural practices are the main cause of deforestation while the 24% agreed that fuel wood collection caused deforestation in the study area. The 19% respondents' view that it is Illegal cutting/ harvesting and while the 9% agreed that encroachment caused deforestation. According to 8% of respondents forest fire is also one of the causes of deforestation.

Table 5: Respondents View about Causes of Deforestation in the Study Area Barawal Dir Upper

S. No	Deforestation Cause	Frequency	%Age
1	Agriculture	30	40
2	Fuel wood	18	24
3	Illegal cutting/ Harvesting	14	19
4	Encroachment	7	9
5	Forest fire	6	8
	Total	**75**	**100**

Determination of Forest Deforestation Drivers through GIS and Remote sensing in Barawal Dir Upper

Changes in Land use and Land Cover from Year 2000 to 2012

The table 6 shows that from year 2000 to 2012 how much land cover has been altered. The outcome of the study clear shows that the forest land largely has been altered / diminished up to 4826 hectare which makes up around 12.36 % from that of image of year 2000. The agriculture land has also expanded around 2930 hectares which make up around 7.5 %.

Table 6: Land Use Land Cover Changes from Year 2000 To 2012

S. No	Class Name	Area Year 2012 In %	Area Year 2000 In %	Area Year 2000 - Area Year 2012
1	Agriculture	12.78	5.28	7.5
2	Barren	41.27	43.29	-2.02
3	Forest	37.27	49.54	-12.36
4	Snow	3.64	0.58	3.23
5	Water	5.14	1.41	3.65
	Total	**100**	**100**	

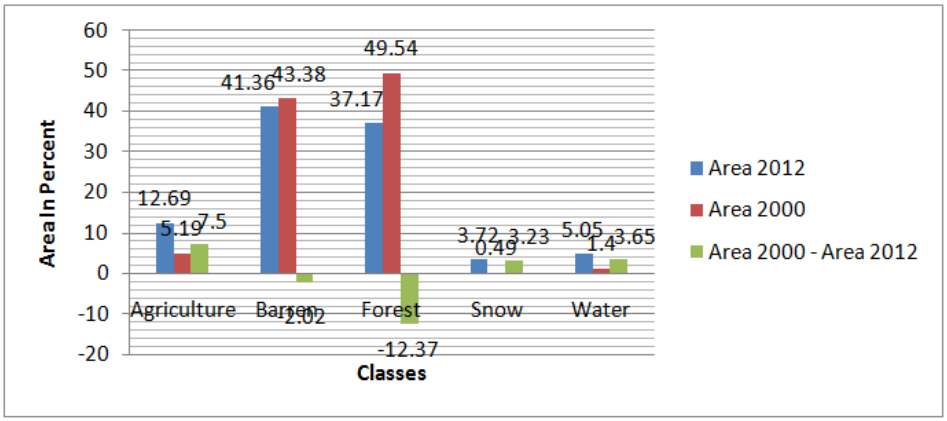

Figure 1: Land Use Land Cover Changes from 2000 to 2012

DISCUSSIONS

The present study was based on satellite image and field survey to identify the drivers of deforestation in the study area

DRIVERS OF DEFORESTION

The majority of residents in study area Barawal Dir upper are illiterate and people did not realize the importance of trees Due to this reason people caused deforestation in the area. Forest cover decreased in study area Barawal Dir upper due to fuel wood collection the (Table 4) showed the fuel wood collection per household per day i.e. collection of 1-30 kg fuel wood per household per day because wood has a significant role to play in meeting the domestic energy requirements. There is no other modern facility like gases, electricity and kerosene oil available, so people only collected the fuel wood for cooking and warming (Table 4). According to (Bekure, 1996) fuel wood collection and encroachment are the key reasons of forest cover change in Ethiopia and (Shackle ton, 2004) reported that the 80% of rural households in South Africa use fuel wood for energy purposes. The wood is also used for construction purposes and manufacturing furniture etc. It is also cleared that 40% of the respondents determined that agricultural practices were the main causes of deforestation in study area Barawal Dir upper. According to (UNFCCC, 2007) that 48% of deforestation is agricultural practices responsible. The United Nations Framework Convention on Climate Change reported that the agriculture was the key roots of deforestation. Different studies have expressed that the forest land is changed to agriculture (Fombed, 2009; Gibbs et al., 2010) and it is also assumed that the demand of food will be increased to 70% by 2050 (FAO, 2009). The study area has been facing serious problem of timber mafia so 19% of the respondents were of the view that illegal cutting and harvesting is the cause of deforestation while 9% accounted that encroachment caused deforestation. To identify the drivers of deforestation through GIS and RS of Barawal Dir upper of year 2000 to 2012 the images of the year 2000 to 2012 were classified into different classes after post classification techniques used by (Coppin et al., 2003).

The GIS and RS data analysis shows that from year 2000 to 2012 the agriculture land was increased by 7% forest area was decreased by 12%. From both field survey and GIS and RS data that are cleared that agriculture practices is main driver of deforestation in Barawal Dir upper.

CONCLUSIONS AND RECOMMENDATIONS

It is finished up from the come about that the woodland spread is diminished because of the seven drivers of

deforestation. These incorporates (i) source of income from forest (ii) fuel wood collection (iii) illiteracy rate (iv) agriculture expansion (v) forest fires (vi) Illegal cutting/harvesting (vii) encroachment. The majority of residents in study area Barawal Dir upper are illiterate and people did not realize the importance of trees. Education plays significant role in spreading data and receiving inventive thoughts to expand family earnings through diverse sources for sustainable livelihood. It is also cleared that 40% of the respondents determined that agricultural practices were the main causes of deforestation in study area Barawal Dir upper. Similarly the forest cover decreased in study area Barawal Dir upper due to fuel wood collection per household per day i.e. collection of 1-30 kg fuel wood per household per day. From RS and GIS data from the year 2000 to 2012 the forest area is decreased by 12% and agriculture area is increased by 7%. From this also clear that agriculture practices is main driver of deforestation in Barawal Dir upper. Due to high deforestation rate and increased agricultural activities it is recommended that awareness campaign should be launched in the study area to protect and conserve this forest from further deforestation

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